The Prisoner's Dilemma and The Tragedy of the Commons

Why is it that sometimes, the only rational choice seems to work against our own common interests?

Game theory explains these situations, and also shows us the way out.

Examples of this abound in real life; environmental degredation highlights this perfectly.

Suppose there is a finite resource (say, fish). On the one hand, we all have seem to have an incentive to use the resource wisely. But if every party is acting independently, if you conserve this resource, there's no guarantee that others will as well--- and there may be none left for you.

In this circumstance, the only rational choice is to take what you can, now!

Unfortunately, this really does happen. (You may not know, but there will be very few wild fish available in a decade or two!)

Industrial pollution provides another example. In the absence of some sort of regulation, industries have no particular incentive to spend money to prevent pollution; if they do spend, they are at a competitive disadvantage.

These situations are modeled by the Prisoner's Dilemma, which also points to a way out of this paradox.

In the Prisoner's Dilemma, you choose whether or not to Cooperate or Defect, with the following payoff matrix.

		Bob C	Bob D
Alice	C	(4,4)	(0,6)
	D	(6,0)	(1,1)

So if Alice defects, scamming Bob who cooperates, Alice gets 6 points and Bob gets nothing.

What is the rational choice for both players?

Alice doesn't know what Bob is going to do. If Bob cooperates, Alice faces a choice between earning 4 points (if she cooperates) and 6 (if she defects). If Bob defects, Alice faces a choice between earning 0 points (if she cooperates) and 1 (if she defects). She has no real choice at all: the only rational thing to do is to defect! No matter what Bob does she'll be better off.

But Bob must reason the same way. The Nash Equilbrium, the "optimal" strategy, is solidly in the lower right-hand corner. And so both Alice and Bob must choose to defect!

How sad: if only they could have trusted one another!

In fact, the mathematician John Von Neumann, an early worker in this area, claimed that just this sort of analysis "proved" the US should launch a nuclear first strike on the USSR! Mercifully the leaders of both countries realized something deep and important seems to be missing from this analysis.

There seems to be something almost unethical about the choice they've been forced into. It's really quite disturbing-- Alice and Bob are nice people but they're both forced to try to scam each other, leading to a poor situation for both of them.

In real life, there are many ways that the equilibrium can be moved, essentially by changing the payoff matrix, or by establishing trust.

Repeated interactions.

What happens if Alice and Bob know they're going to play the game 1000 times? In this run, they know they are going to be much better off in the long run if they can establish trust with each other. The occasional temptation to scam the other is not worth the long term damage to this relationship. And indeed, this is just what happens: we trust our friends and cooperate with them.

Ethics and norms for social behavior

Ethics can be seen in this light. In just the same way as with two players, we can imagine societies with lots of different kinds of people, following different strategies, playing against each other. Who will be more successful in the long run?

In the long run, societies that are full of defectors will end up doing very poorly indeed!

What about mixed societies with both kinds of players? Cooperators will not do well against defectors, and won't do as well with each other as a freeloading defector would. But if there are too many defectors, the society as a whole will fail, and won't be able to thrive-- especially if the society as a whole is in competition with other, more cooperative ones.

In some ways, this can be seen as the basis for ethics and the Golden Rule. These kinds of societal norms help ensure that people will cooperate, even with strangers, much of the time, leading to the good of society as a whole.

Government, laws and treaties

Government and the rule of law is essentially a way to formalize this arrangement. The fundamental reason governments exist is to shift the equilibrium point to work for the collective good. Taxes, laws, regulation and government itself are tools that societies have developed to ensure that individuals have strong incentives to work for the common good. Treaties play the same role between governments.

As appealling as the idea that all should work solely in their own direct selfish interest, the result is anarchy and devastation (the recent financial crisis is a perfect example of the need for strong regulation). Which isn't to say that acting in our own self-interest shouldn't be a fundamental principle; rather, the function of government is to set up the playing field so that rational individual interests coincide more completely with the common good.